

AMENDMENTS TO THE CLAIMS

1. (Original) A method of producing hydrogen by supplying steam to a cathode side and supplying a reducing gas to an anode side of a high-temperature steam electrolysis apparatus in which an electrolysis vessel is partitioned into the anode side and the cathode side using a solid oxide electrolyte membrane as a diaphragm, and carrying out steam electrolysis at high temperature,

the method being characterized in that the reducing gas and the steam supplied into the electrolysis vessel are made to have a temperature in a range of 200 to 500°C.

2. (Original) The method of producing hydrogen according to claim 1, characterized in that the reducing gas and the steam supplied are heated to a temperature in a range of 200 to 500°C by carrying out heat exchange with high-temperature offgas and high-temperature hydrogen.

3. (Original) The method of producing hydrogen according to claim 1, characterized in that the reducing gas and the steam supplied are heated to a temperature in a range of 200 to 500°C by carrying out heat exchange with waste heat from another process.

4. (Original) The method of producing hydrogen according to claim 1, characterized in that the supplied reducing gas is heated to a temperature in a range of 200 to 500°C by adding high-temperature gas thereto.

5. (Currently Amended) The method of producing hydrogen according to claim 1-~~or 4~~, characterized in that the supplied reducing gas or mixed gas of the reducing gas and high-temperature gas, and the steam are heated to a temperature in a range of 200 to 500°C by carrying out heat exchange with high-temperature offgas and high-temperature hydrogen.

6. (Currently Amended) The method of producing hydrogen according to claim 1-~~or 4~~, characterized in that the supplied reducing gas or mixed gas of the reducing gas and high-temperature gas is heated to a temperature in a range of 200 to 500°C by carrying out heat exchange with waste heat from another process.

7. (Currently amended) The method of producing hydrogen according to ~~any of claims 1 through 6~~ claim 1, characterized by operating with an electrolysis voltage in a range of 20 to 40% of a required energy.

8. (Currently Amended) The method of producing hydrogen according to ~~any of claims 1 through 7~~ claim 1, characterized in that a concentration of hydrochloric acid and/or sulfur compounds in the supplied reducing gas is made to be not more than 10 ppm.

9. (Currently Amended) The method of producing hydrogen according to ~~any of claims 1 through 8~~ claim 1, characterized in that the supplied reducing gas is a reducing gas produced through pyrolysis of organic matter, and is cleaned/de-dusted using a scrubber or the like.

10. (Currently Amended) The method of producing hydrogen according to ~~any of claims 1 through 8~~ claim 1, characterized in that the supplied reducing gas is by-product gas produced by a coke oven or a blast furnace of an ironworks.

11. (Currently Amended) The method of producing hydrogen according to ~~any of claims 1 through 8~~ claim 1, characterized in that the supplied reducing gas is by-product gas from a petroleum plant.

12. (Original) The method of producing hydrogen according to claim 9, characterized in that the pyrolysis raw material organic matter is biomass such as waste wood or garbage, and petroleum residue.

13. (Original) A hydrogen producing apparatus comprising an electrolysis vessel partitioned into an anode side and a cathode side by a solid oxide electrolyte diaphragm, a pipeline supplying a reducing gas to the anode side of the electrolysis vessel, and a pipeline supplying steam to the cathode side of the electrolysis vessel,

characterized by further comprising means for heating

the reducing gas and the steam supplied into the electrolysis vessel to a temperature in a range of 200 to 500°C.

14. (Original) The hydrogen producing apparatus according to claim 13, characterized in that a flow control valve is provided in each of the pipeline supplying the reducing gas to the anode side of the electrolysis vessel and the pipeline supplying the steam to the cathode side of the electrolysis vessel, so as to optimally control operating conditions.

15. (Original) The hydrogen producing apparatus according to claim 14, characterized in that a temperature gauge is provided in a gas outlet line on the anode side and the cathode side of the electrolysis vessel, and the flow control valves are controlled so as to obtain a constant temperature.

16. (New) A system for producing hydrogen by supplying steam to a cathode side and supplying a reducing gas to an anode side of a high-temperature steam electrolysis apparatus in which an electrolysis vessel is partitioned into the anode side and the cathode side using a solid oxide electrolyte as a diaphragm, and carrying out steam electrolysis at high temperature,

the system being characterized by having means for heating at least one of the reducing gas supplied to the anode side and the steam supplied to the cathode side.

17. (New) A system for producing hydrogen by supplying steam to a cathode side and supplying a reducing gas to a cathode side of a high-temperature steam electrolysis apparatus in which an electrolysis vessel is partitioned into the anode side and the cathode side using a solid oxide electrolyte as a diaphragm, and carrying out steam electrolysis at high temperature,

the system being characterized by having means for recovering heat from at least one of high-temperature exhaust gas discharged from the anode side and high-temperature hydrogen-containing gas discharged from the cathode side of the high-temperature steam electrolysis apparatus.

18. (New) A system for producing hydrogen by supplying steam to a cathode side and supplying a reducing gas to an anode side of a high-temperature steam electrolysis apparatus in which an electrolysis vessel is partitioned into the anode side and the cathode side using a solid oxide electrolyte as a diaphragm, and carrying out steam electrolysis at high temperature,
the system being characterized by having means for recovering heat from at least one of high-temperature exhaust gas discharged from the anode side and high-temperature hydrogen-containing gas discharged from the cathode side of the high-temperature steam electrolysis apparatus, and means for heating at least one of the reducing gas supplied to the anode side and the steam supplied to the cathode side of the high-temperature steam electrolysis apparatus using the recovered heat.

19. (New) A system for producing hydrogen by supplying steam to a cathode side and supplying a reducing gas to an anode side of a high-temperature steam electrolysis apparatus in which an electrolysis vessel is partitioned into the anode side and the cathode side using a solid oxide electrolyte as a diaphragm, and carrying out steam electrolysis at high temperature,
the system being characterized by having means for adjusting a temperature of at least one of the reducing gas supplied to the anode side and the steam supplied to the cathode side of the high-temperature steam electrolysis apparatus, and recovering heat from at least one of high-temperature exhaust gas discharged from the anode side and high-temperature hydrogen-containing gas discharged from the cathode side of the high-temperature steam electrolysis apparatus.

20. (New) The system for producing hydrogen according to claim 16, wherein some of the reducing gas supplied to the anode side of the high-temperature steam electrolysis apparatus is branched off and combusted, and the remainder of the reducing gas is heated using heat from the combustion and then supplied to the anode side of the high-temperature steam electrolysis apparatus.

21. (New) The system for producing hydrogen according to claim 16, characterized in that waste heat produced from a waste treatment facility, a power plant, a heat utilizing facility or a city infrastructure facility, heat from an industrial furnace, heat from a plant, or heat produced

from a coal mine facility is used as heat source for heating at least one of the reducing gas supplied to the anode side of the high-temperature steam electrolysis apparatus and the steam.

22. (New) The system for producing hydrogen according to claim 16, characterized in that electrical power supplied into the high-temperature steam electrolysis apparatus is supplied from outside.

23. (New) The system for producing hydrogen according to claim 16, wherein steam accompanying the manufactured hydrogen gas is recovered as condensed water using a condenser, and the recovered water is used as raw water for producing the high-temperature steam supplied into the high-temperature steam electrolysis apparatus.

24. (New) The system for producing hydrogen according to claim 16, characterized in that exhaust gas discharged from the anode side of the high-temperature steam electrolysis apparatus is combusted, heat from the combustion is recovered using a heat exchanger, and the recovered heat is used as a heating source for at least one of the reducing gas supplied to the anode side and the steam supplied to the cathode side of the high-temperature steam electrolysis apparatus.

25. (New) The system for producing hydrogen according to claim 17, wherein some of the reducing gas supplied to the anode side of the high-temperature steam electrolysis apparatus is branched off and combusted, and the remainder of the reducing gas is heated using heat from the combustion and then supplied to the anode side of the high-temperature steam electrolysis apparatus.

26. (New) The system for producing hydrogen according to claim 18, wherein some of the reducing gas supplied to the anode side of the high-temperature steam electrolysis apparatus is branched off and combusted, and the remainder of the reducing gas is heated using heat from the combustion and then supplied to the anode side of the high-temperature steam electrolysis apparatus.

27. (New) The system for producing hydrogen according to claim 19, wherein some of the reducing gas supplied to the anode side of the high-temperature steam electrolysis apparatus is

branched off and combusted, and the remainder of the reducing gas is heated using heat from the combustion and then supplied to the anode side of the high-temperature steam electrolysis apparatus.

28. (New) The system for producing hydrogen according to claim 17, characterized in that waste heat produced from a waste treatment facility, a power plant, a heat utilizing facility or a city infrastructure facility, heat from an industrial furnace, heat from a plant, or heat produced from a coal mine facility is used as heat source for heating at least one of the reducing gas supplied to the anode side of the high-temperature steam electrolysis apparatus and the steam.

29. (New) The system for producing hydrogen according to claim 18, characterized in that waste heat produced from a waste treatment facility, a power plant, a heat utilizing facility or a city infrastructure facility, heat from an industrial furnace, heat from a plant, or heat produced from a coal mine facility is used as heat source for heating at least one of the reducing gas supplied to the anode side of the high-temperature steam electrolysis apparatus and the steam.

30. (New) The system for producing hydrogen according to claim 19, characterized in that waste heat produced from a waste treatment facility, a power plant, a heat utilizing facility or a city infrastructure facility, heat from an industrial furnace, heat from a plant, or heat produced from a coal mine facility is used as heat source for heating at least one of the reducing gas supplied to the anode side of the high-temperature steam electrolysis apparatus and the steam.

31. (New) The system for producing hydrogen according to claim 17, characterized in that electrical power supplied into the high-temperature steam electrolysis apparatus is supplied from outside.

32. (New) The system for producing hydrogen according to claim 18, characterized in that electrical power supplied into the high-temperature steam electrolysis apparatus is supplied from outside.

33. (New) The system for producing hydrogen according to claim 19, characterized in that electrical power supplied into the high-temperature steam electrolysis apparatus is supplied from outside.

34. (New) The system for producing hydrogen according to claim 17, wherein steam accompanying the manufactured hydrogen gas is recovered as condensed water using a condenser, and the recovered water is used as raw water for producing the high-temperature steam supplied into the high-temperature steam electrolysis apparatus.

35. (New) The system for producing hydrogen according to claim 18, wherein steam accompanying the manufactured hydrogen gas is recovered as condensed water using a condenser, and the recovered water is used as raw water for producing the high-temperature steam supplied into the high-temperature steam electrolysis apparatus.

36. (New) The system for producing hydrogen according to claim 19, wherein steam accompanying the manufactured hydrogen gas is recovered as condensed water using a condenser, and the recovered water is used as raw water for producing the high-temperature steam supplied into the high-temperature steam electrolysis apparatus.

37. (New) The system for producing hydrogen according to claim 17, characterized in that exhaust gas discharged from the anode side of the high-temperature steam electrolysis apparatus is combusted, heat from the combustion is recovered using a heat exchanger, and the recovered heat is used as a heating source for at least one of the reducing gas supplied to the anode side and the steam supplied to the cathode side of the high-temperature steam electrolysis apparatus.

38. (New) The system for producing hydrogen according to claim 18, characterized in that exhaust gas discharged from the anode side of the high-temperature steam electrolysis apparatus is combusted, heat from the combustion is recovered using a heat exchanger, and the recovered heat is used as a heating source for at least one of the reducing gas supplied to the anode side and the steam supplied to the cathode side of the high-temperature steam electrolysis apparatus.

39. (New) The system for producing hydrogen according to claim 19, characterized in that exhaust gas discharged from the anode side of the high-temperature steam electrolysis apparatus is combusted, heat from the combustion is recovered using a heat exchanger, and the recovered heat is used as a heating source for at least one of the reducing gas supplied to the anode side and the steam supplied to the cathode side of the high-temperature steam electrolysis apparatus.